

## SECTION 23 3100

### HVAC DUCTS AND CASINGS

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#### LANL MASTER SPECIFICATION

When editing to suit project, author shall add job-specific requirements and delete only those portions that in no way apply to the activity (e.g., a component that does not apply). To seek a variance from applicable requirements, contact the ESM Mechanical POC.

When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General Requirements.

Delete information within "stars" during editing.

Specification developed for ML-3 /ML- 4 projects. For ML-1 / ML-2, additional requirements and QA reviews are required.

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#### PART 1 GENERAL

##### 1.1 SUMMARY

- A. Section includes ductwork, duct cleaning, duct sealing, and [duct leakage test].

##### 1.2 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes other than those of equivalent or lower loss coefficient is permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

##### 1.3 SUBMITTALS

- A. Submit the following in accordance with Section 01 3300, Submittal Procedures:
  - 1. Catalog data for duct materials, flexible duct/connectors, sealing materials.
  - 2. Shop drawings indicating duct layout with pressure classification and sizes, fittings, hangers and supports, [seismic restraints], seam and joint construction, connections to equipment such as coils, etc., for pressure class ducts [ ] inches and greater.
  - 3. Test Reports indicating pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

##### 1.4 QUALITY ASSURANCE

- A. Construct ductwork in accordance with SMACNA - HVAC Duct Construction Standards - Metal and Flexible, and NFPA 90A.

- B. Fiberboard duct is not acceptable duct material except when used for fabricating return air sound traps.

## 1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years experience.
- B. Installer: Company specializing in performing work of this section with minimum 3 years experience approved by manufacturer.

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealant when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealant.

## 1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

# PART 2 PRODUCTS

## 2.1 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Alternate products may be accepted; follow Section 01 2500, Substitution Procedures.

## 2.2 DUCT MATERIALS

- A. Galvanized Steel Ducts: ASTM A653 galvanized steel sheet, lock-forming quality, having G90 zinc coating of in conformance with ASTM A90.

\*\*\*\*\* [OR] \*\*\*\*\*

- B. Steel Ducts: ASTM [A366] [A569] [A568].

\*\*\*\*\* [OR] \*\*\*\*\*

- C. Aluminum Ducts: ASTM B209, aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

\*\*\*\*\* [OR] \*\*\*\*\*

- D. Stainless Steel Ducts: ASTM A167, Type [304.] [316.]

\*\*\*\*\* [OR] \*\*\*\*\*

- E. PVC Coated Ductwork: Fabricate from ASTM A653 galvanized steel sheet with minimum G60 zinc coating per ASTM A90. Provide 4 mil coating on both sides meeting UL 181, Class 1 requirements. PVC coating shall be uniform, smooth, and free from scratches or other imperfections. Cover scratches with manufacturer's touch-up paint.
- F. Fasteners: Rivets, bolts, or sheet metal screws.
- G. Hanger Rod: ASTM A36; steel threaded both ends, threaded one end, or continuously threaded. Use galvanized steel or aluminum, 6061-T6, hangers in contact with aluminum duct.
- H. Hanger Straps: ASTM A653 galvanized steel having G90 zinc coating in conformance with ASTM A90.
- I. Structural Steel Members: ASTM A36 steel. Use aluminum, 6061-T6 or galvanized steel members for aluminum ducts.

## 2.3 DUCTWORK FABRICATION

- A. Fabricate ductwork and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible. Furnish duct material, gages, reinforcing, and sealing for pressure class indicated.
- B. Construct T's, bends, and elbows with minimum radius 1-1/2 times centerline duct width. Where not possible and where rectangular elbows are used, provide single thickness turning vanes constructed and installed in accordance with SMACNA Standards. Vanes are not required in return air sound trap elbows and transfer ducts.
- C. Fabricate continuously welded round and oval duct fittings two gages heavier than duct gages indicated in SMACNA Standard.
- D. Provide, at minimum, rectangular 45 degree entry fittings for rectangular ducts and 45 degree wye takeoffs for round ducts.
- E. Duct sizes noted are inside clear dimensions. [For lined ducts, maintain duct sizes inside lining.]
- F. Increase duct size gradually, not exceeding 15 degree divergence wherever possible. Do not exceed 30-degree divergence upstream of equipment. Do not exceed 45-degree convergence downstream of equipment.

## 2.4 FLEXIBLE DUCTS (INSULATED, LOW PRESSURE)

- A. Manufacturer: Flexmaster, Type 5.
- B. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on

the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A.

1. Pressure Rating: 6 inches w.g. positive, 4 inches w.g. negative through 16 inches diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
2. Rated Velocity: 4000 fpm.
3. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.
4. Insulation: Fiberglass, minimum R value 4.2 at mean temperature of 75 degrees F.

## 2.5 FLEXIBLE DUCTS (INSULATED, HIGH PRESSURE)

- A. Manufacturer: Flexmaster, Type 3.
- B. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A.
  1. Pressure Rating: 12 inches w.g. positive, 5 inches w.g. negative through 16 inch diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
  2. Rated Velocity: 5500 fpm.
  3. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.
  4. Insulation: Fiberglass, minimum R value 4.2 at mean temperature of 75 degrees F.

## 2.6 FLEXIBLE DUCTS (NON-INSULATED, LOW TO HIGH PRESSURE)

- A. Manufacturer: Flexmaster, Type NI-35.
- B. Duct assembly of a trilaminate of aluminum foil, fiberglass, and aluminized polyester, mechanically locked (no adhesives) into an aluminum helix formed on the ducts outside surface, insulation encased in a fire retardant protective barrier, duct UL listed 181 class 1, and complies with NFPA 90A.
  1. Pressure Rating: 12 inches w.g. positive, 5 inches w.g. negative through 16 inches diameter, 1 inch w.g. negative for 18 inches and 20 inches diameter.
  2. Rated Velocity: 6500 fpm.
  3. Temperature Rating: Minus 20 degrees F to plus 250 degrees F.

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Provide flexible connections immediately adjacent to suction and discharge ends of moving equipment, e.g., fans, etc.  
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## 2.7 FLEXIBLE CONNECTIONS (EXPOSED TO SUN AND WEATHER)

- A. Manufacturer: Ventfabrics, Ventlon.
- B. 24 gage metaledge ventlon (glass fiber coated with hypalon), fire retardant, UL Standard 214, and complies with NFPA-90A.
  - 1. Pressure Rating: 10 inches w.g., negative and positive.
  - 2. Temperature Rating: Minus 10 degrees F to plus 275 degrees F.
  - 3. Weight: 26 oz/sq yd plus or minus 2 ounces.

## 2.8 FLEXIBLE CONNECTIONS (INDOOR)

- A. Manufacturer: Ventfabrics, Ventlon.
- B. 24 gage metaledge ventlon (glass fiber coated with hypalon), fire retardant, UL Standard 214, and complies with NFPA-90A.
  - 1. Pressure Rating: 10 inches w.g. negative and positive.
  - 2. Temperature Rating: Minus 20 degrees F to plus 200 degrees F.
  - 3. Weight: 30 oz/sq yd plus or minus 3 ounces.

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When specifying spiral seam ductwork, check the manufacturer's data for standard stock sizes.  
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## 2.9 SPIRAL ROUND AND FLAT OVAL DUCT

- A. Machine made spiral lock-seam duct with light reinforcing corrugations. Fittings: Welded seam construction, manufactured of at least two gages heavier metal than duct.

## 2.10 DUCT LINER

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See ESM Mechanical Chapter, D3040, for duct lining limitations.  
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- A. Manufacturer: CertainTeed, Tough Gard with Enhanced Surface.
- B. Composed of long textile type glass fibers with thermosetting resin overlaid with a tough and durable fire resistive black composite surface on the air stream. The air stream surface shall contain an EPA registered antimicrobial agent to reduce

the potential of microbial growth. Flame spread/smoke developed 25/50 maximum meeting NFPA 90A requirements.

1. Thickness: [1] inch.
2. Velocity Rating: 6000 fpm.
3. Temperature Rating: 250 degrees F.
4. Minimum Density: [1 1/2 ] pcf.

## 2.11 AIR DUCT BOARD

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Use this material ONLY for fabricating return air sound traps per mechanical standard drawing ST-D3040-2. Specify black mat interior finish where reflection (dark rooms, etc.) or aesthetics is a concern.

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- A. Manufacturer: CertainTeed, Tough Gard with Enhanced Surface.
- B. Rigid resin-bonded fiberglass board faced on exterior side with foil-scrim-kraft (FSK) vapor retarder, and air stream surface faced with a tightly bonded non-woven black mat facing or impregnated with a polymer coating. Service temperature 250 degrees F maximum, air velocity 5000 fpm maximum, and internal static pressure plus or minus 2 inches water maximum. The air stream surface shall contain EPA registered antimicrobial agent to reduce the potential of microbial growth. Flame spread/smoke developed 25/50 maximum meeting NFPA 90A requirements, thickness 1 inch.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify sizes of equipment connection before fabricating transitions.

### 3.2 INSTALLATION

- A. Install and support ductwork in accordance with SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- B. During construction, install temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.
- C. Use double nuts and lock washers on threaded rod supports.
- D. Connect flexible ducts to metal ducts with draw bands.
- E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

- F. Provide factory fabricated balancing dampers with indicating type locking quadrant where noted on drawing.
  - 1. Dampers are not required upstream or downstream of VAV boxes serving only one diffuser.
  - 2. Do not use splitter dampers.
  - 3. Locate balancing dampers as far as possible (recommend no closer than 5 feet) from air terminals to avoid excessive noise.
- G. Provide flexible connections with minimum 1 inch slack immediately adjacent to equipment in ducts associated with fans and motorized equipment.
- H. Limit flexible ductwork to diffusers, terminal units, or light troffer boots, to 5 feet in length.
  - 1. Do not install flexible ductwork upstream of VAV boxes.
  - 2. Provide rigid straight ductwork, 2 duct diameters or a minimum of 12 inches, downstream of VAV boxes.

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Refer to NFPA 90A-2002, Annex A, Section A.4.3.4.1 and SMACNA Fire, Smoke and Radiation Dampers Installation guide for HVAC System for fire damper access door sizes, locations, etc.  
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- I. Provide duct access doors for inspection and cleaning upstream of filters, coils, automatic dampers, and equipment as indicated on drawings. Provide minimum 8 X 8 inch size for hand access, 18 X 18 inch size for shoulder access.
  - 1. Provide duct access door for fire damper, size [18 x 18 min., 24 x 24 max.]
- J. Where indicated, weld or braze duct joints and seams in accordance with AWS D9.1.
- K. Repair damaged galvanized ductwork surfaces (welds, scratches, etc.) by applying minimum 2 coats of a zinc base paint.
- L. Paint exposed ductwork in occupied areas to match surroundings. Refer to Section 09900, Painting. [Optional requirement, consult with user. Specify color if necessary.]
- M. Provide duct drops to diffuser same size as diffuser neck size.
- N. Provide UL/FM approved through-penetration firestop system when penetrating fire-rated barriers (i.e., walls, floors, etc).
- O. Install openings in ductwork where required to accommodate thermometers and controllers. Install pitot tube openings for testing of systems. Install pitot tube complete with metal can with spring device or screw to prevent air leakage.

Where openings are provided in insulated ductwork, install insulation material inside metal ring.

- P. Secure duct liner with mechanical fasteners and adhesive per SMACNA duct liner standards and/or manufacturer's installation specifications. Coat all raw exposed edges per manufacturer's instructions.
- Q. Insulate ductwork in accordance with Section 22 0713, Plumbing and HVAC Insulation.

### 3.3 CLEANING

- A. After completing system installation and inspection, clean duct systems in accordance with National Air Duct Cleaners Association (NADCA) specifications
  - 1. The cleaning contractor shall be a certified member of NADCA, or shall be certified by a nationally recognized program and organization.

### 3.4 DUCTWORK MATERIAL SCHEDULE

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Include a material schedule when project contains more than one system with different duct materials.

The following is an example of a schedule.

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- A. Fabricate ducts from galvanized steel except for the following air systems:

<u>AIR SYSTEM</u>	<u>MATERIAL</u>
Fume Hood Exhaust	Stainless Steel
Emergency Generator Exhausts	Steel, Schedule 40 pipe.

### 3.5 DUCTWORK PRESSURE CLASSIFICATION

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Each duct system is constructed for the specific pressure classification selected by the designer. This information must be noted on the drawings or in this specification if the pressure class exceeds 1-inch w.g. For guidance on pressure classification refer to SMACNA HVAC Duct Construction Standards, Metal and Flexible. The following is an example.

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- A. Construct each duct system for a minimum pressure classification of 1 inch w.g., and as follows:
  - 1. Supply Ducts: [3] inch w.g. pressure duct from air handling unit to VAV terminal unit.
  - 2. Supply Ducts: [2] inches pressure duct from VAV terminal unit to diffuser.
  - 3. Return Ducts: [2] inches w.g., negative pressure.

4. Exhaust Ducts: [2] inches w.g., negative pressure.

### 3.6 DUCT SEALING

- A. Seal duct seams and joints in accordance to the duct pressure classification as described in SMACNA HVAC Duct Construction Standards-Metal and Flexible.
- B. Do not use pressure-sensitive sealant on ducts with a pressure class of 1 inch w.g. or greater.

### 3.7 DUCT LEAKAGE

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ASHRAE Standard 90.1-2004 (Section 6.4.4.2.2) does not require leakage testing for ducts constructed to 3 inches or less pressure class. The following is an example leakage test spec for any pressure class (edit to suit). Note: It may be inadequate for nuclear facilities.

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- A. Leak test ducts with a pressure class in excess of [3] inches w.g.
- B. Perform leakage tests in accordance with the SMACNA HVAC Duct Leakage Test Manual, using tests forms equivalent to those outlined in manual.
- C. The entire duct systems need not to be tested. Tests may be made for only representative sections provided these sections represent at least 25 percent of the total installed duct area for the tested pressure class.
- D. Maximum Allowable Leakage: Comply with the following requirements
  1. Leakage Classification [3] for round and flat oval ducts.
  2. Leakage Classification [12] for rectangular ducts, 2 inches w. g. or less.
  3. Leakage Classification [6] for rectangular ducts, 2-10 inches w.g.
- E. Remake leaking joints and retest to ensure leakage is less than the minimum allowed.

### END OF SECTION

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Do not delete the following reference information.

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### FOR LANL USE ONLY

This project specification is based on LANL Master Specification 23 3100 Rev. 0, dated January 6, 2006.